APS Update

G. Brian Stephenson

APSUOSC and APS PUC Joint Meeting

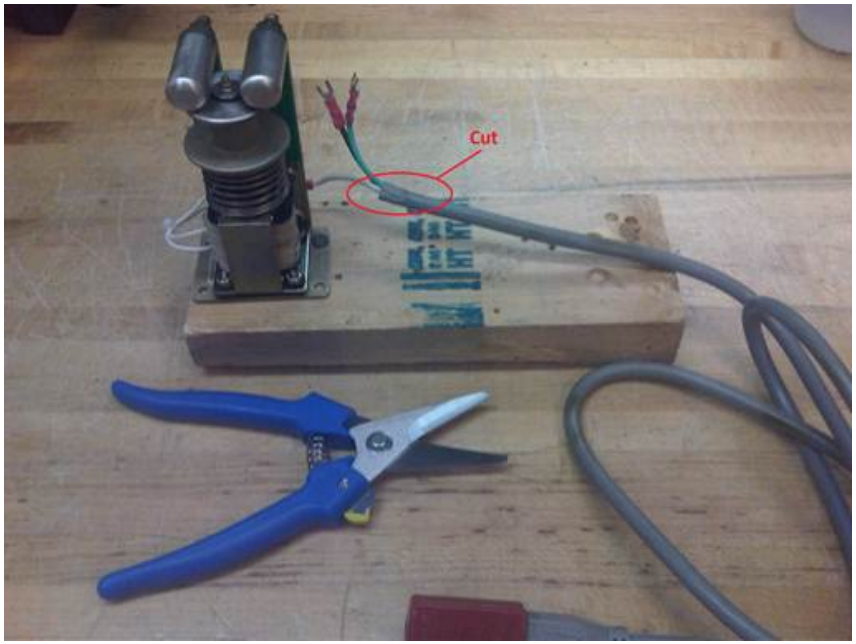
September 19, 2012

APS Update

- Safety
- Science Highlights
- Machine Performance, 150 mA Studies
- New Buildings, Vibration Monitoring
- DCS Project (Dynamic Compression) progress
- Trends in Users and Staffing
- Adding BM Capacity for NSLS-I to NSLS-II Transition
- User Support Space Planning
- Outreach: NX School, ESRP, Energy Showcase

Recent APS Injury

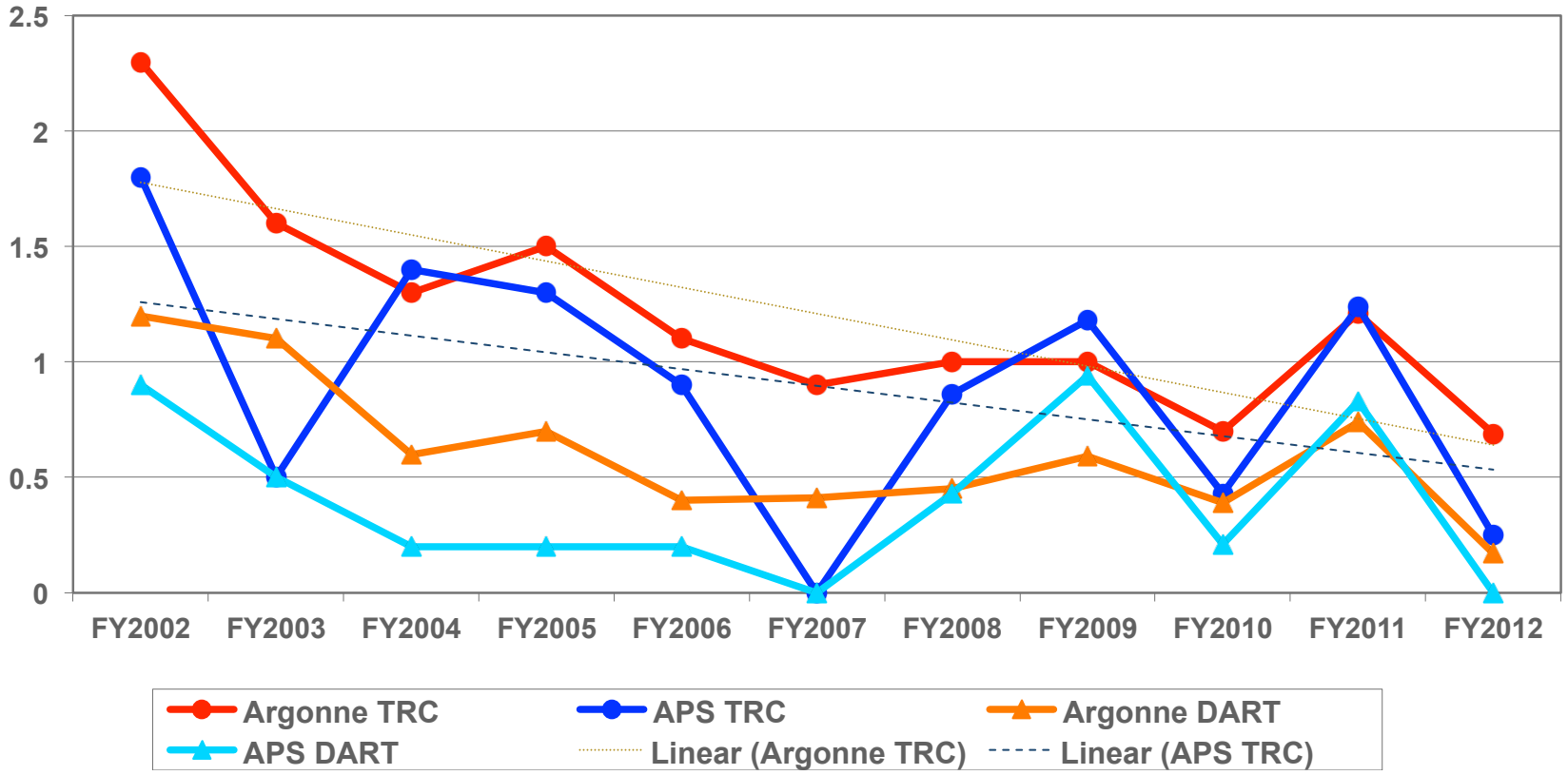
- Employee preparing AC cable
- Had to remove additional outer insulation to free up inner wires
- Used new pair of specialty shears to slit insulation sheath along length
- Cut towards hand holding cable
- Shears cut quicker than expected and hit worker's right thumb
- Cut took seven stitches to close
- **Always cut away from body & fingers**



Near Miss

- APS employee was re-stacking shielding in accelerator
- 50-lb piece was bumped off edge of pallet and fell 3 feet to hit toe
- Safety shoe steel toe deflected blow and injury was avoided
- Procedure and equipment for restacking shielding is being revised to prevent recurrance
- **Wear your safety shoes when working around heavy materials**

APS TRC & DART Rates *(Estimated thru August 2012)*

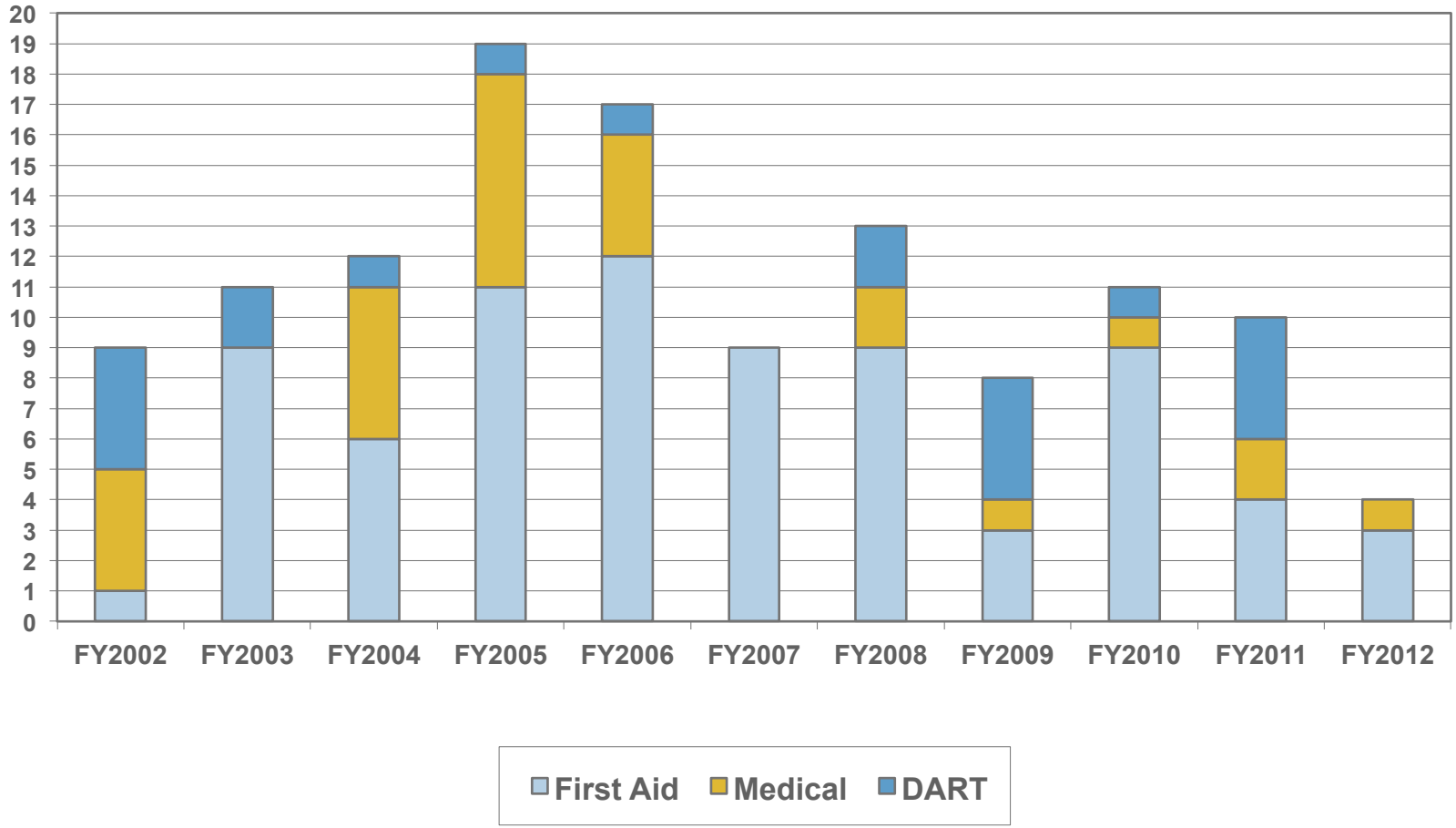


TRC = Total OSHA Recordable Case Rate per 200,000 Hours Worked

DART = Days Away, Restricted Duty, or Job Transfer Case Rate per 200,000 Hours Worked

FY2002-4 APS Divs. FY2005-8 SUF (APS Divs.+ IPNS) FY2009-12 PSC (APS Divs. Only)

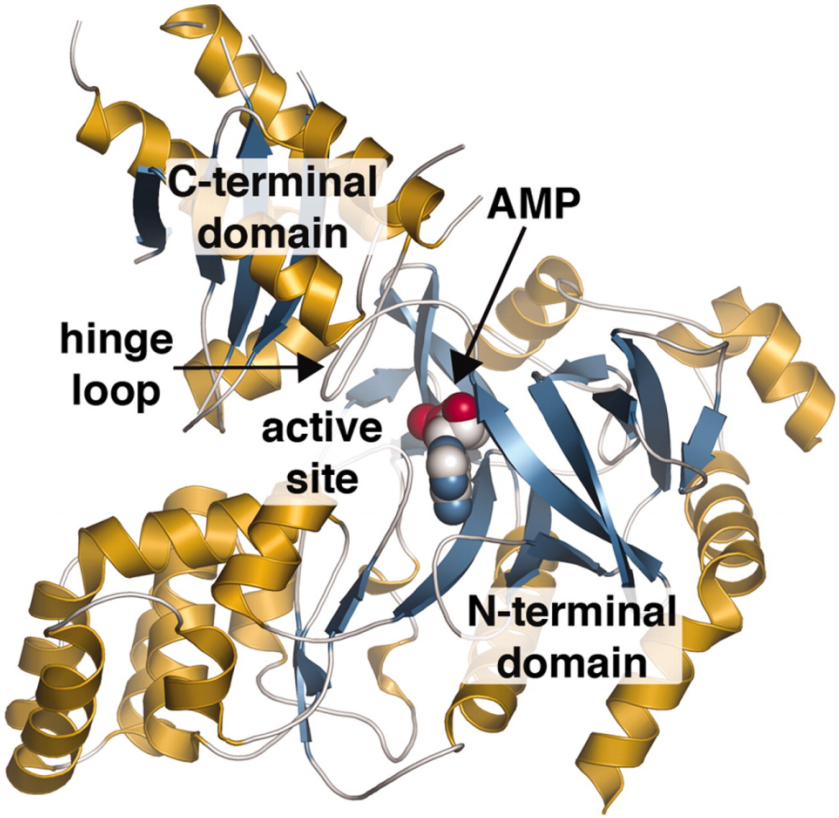
APS - Total Injuries + Number in Each Category



FY2002-4 APS Divs. FY2005-8 SUF (APS Divs.+ IPNS) FY2009-12 PSC (APS Divs. Only)

Plants' Rapid Response System Revealed

- A cross-Atlantic collaboration working the SBC-CAT 19-ID x-ray beamline at the U.S. Department of Energy Office of Science's Advanced Photon Source at Argonne National Laboratory and at the ESRF has revealed the workings of a switch that activates plant hormones, tags them for storage, or marks them for destruction
- The research is relevant not just to the design of herbicides but also to genetic modification of plants to suit more extreme growing conditions due to climate change



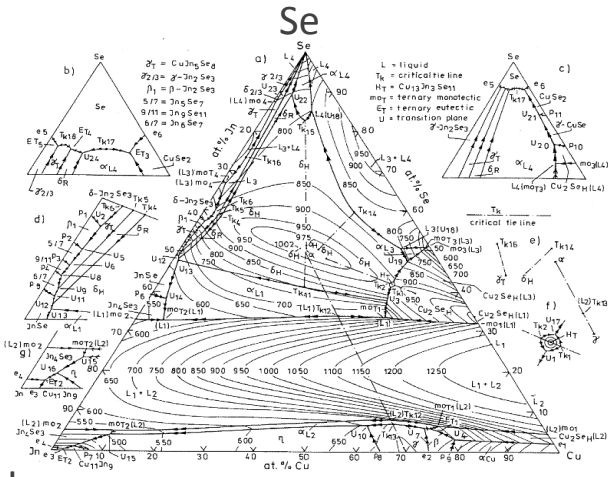
Ribbon diagram of overall structure of AtGH3 protein.
From C.S. Westfall et al., Science **336**, 1708 (2012).

C.S. Westfall, J. Herrmann, & J.M. Jez (Washington Univ.); C. Zubieta & U. Kapp (European Synchrotron Radiation Facility); M.H. Nanao (European Molecular Biology Laboratory & UJF-EMBL-CNRS)

C.S. Westfall et al., Science 336, 1708 (29 June 2012). DOI: 10.1126/science.1221863

DOW POWERHOUSE™ Solar Shingles: Reinventing the Roof

- In situ x-ray diffraction / differential scanning calorimetry studies by researchers from Dow Chemical using the DND-CAT beamlines at APS were used to investigate process / structure / property relationships in CuInGaSe materials (the active material in the first 'solar shingles').



Research at APS (2007-2009)

Opening 2013
Will employ 1200 people by 2015

Phases, Kinetics, Processing → Manufacturing → Solar power that isn't on the roof, but IS the roof!

B. Landes, S. Rozeveld, B. Kern, B. Nichols, and J. Gerbi (Dow Chemical Co.)

POWERHOUSE™ DOW SOLAR

Record Machine Performance for FY12

Run 2011-3: MTBF 220 hours (7 faults), 99.6% available
Run 2012-1: MTBF 287 hours (6 faults), 99.7% available
Run 2012-2: MTBF 142 hours (12 faults), 98.9% available

Argonne Today

Argonne NATIONAL LABORATORY

Daily Newsletter for Argonne Employees — March 1, 2012

SAFETY FOCAL POINT

PPE Road Show

INSIDE ARGONNE

Community
Cost Savings Ideas
Event Calendar
Freecycle@Work
Green Lab Initiative
Job Board
Safety
Travel

FOOD

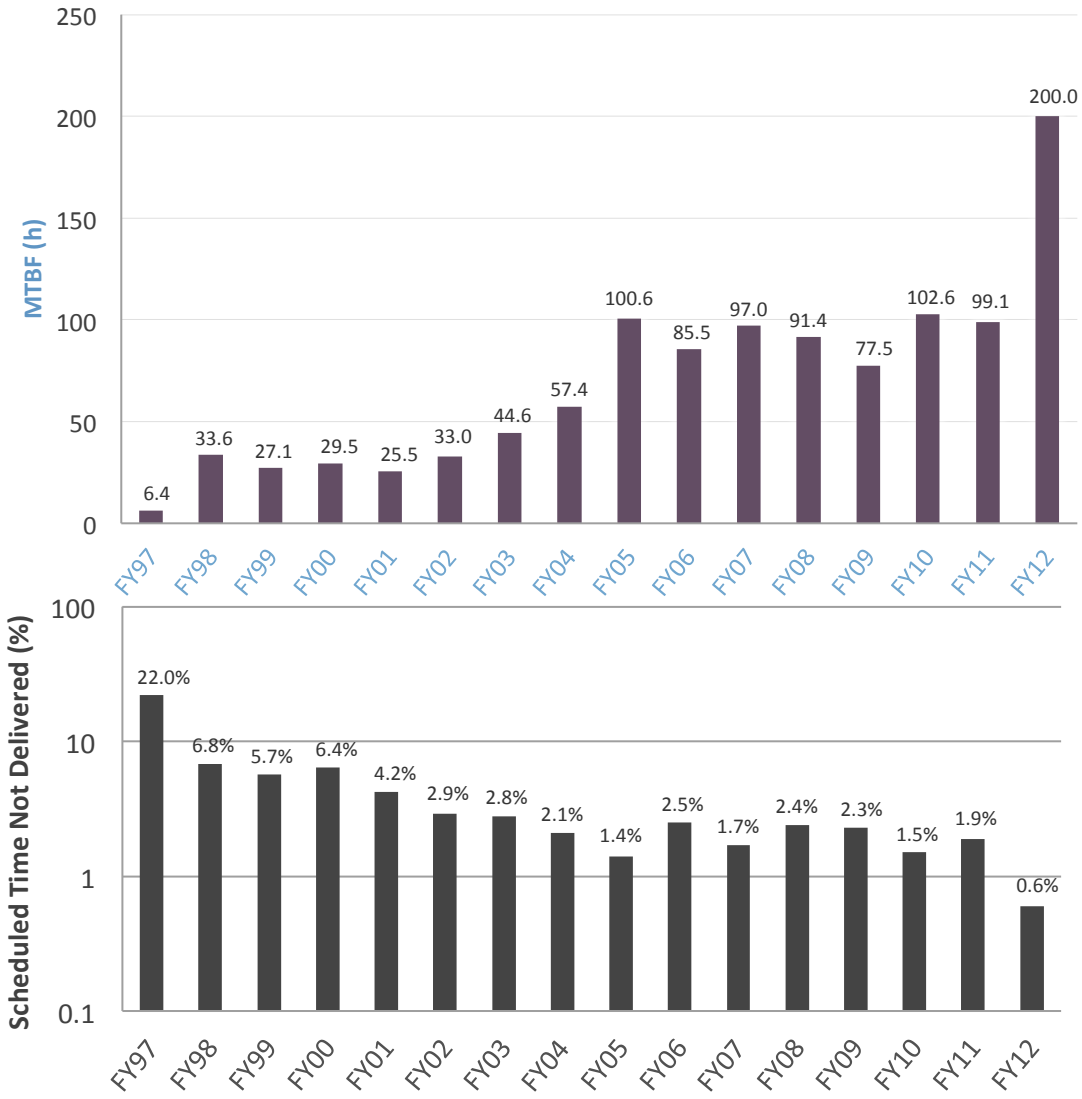
213 Cafe
401 Grill

Record-setting run at APS

The recently completed user-beam run at Argonne's Advanced Photon Source set a new record for machine availability and reliability.

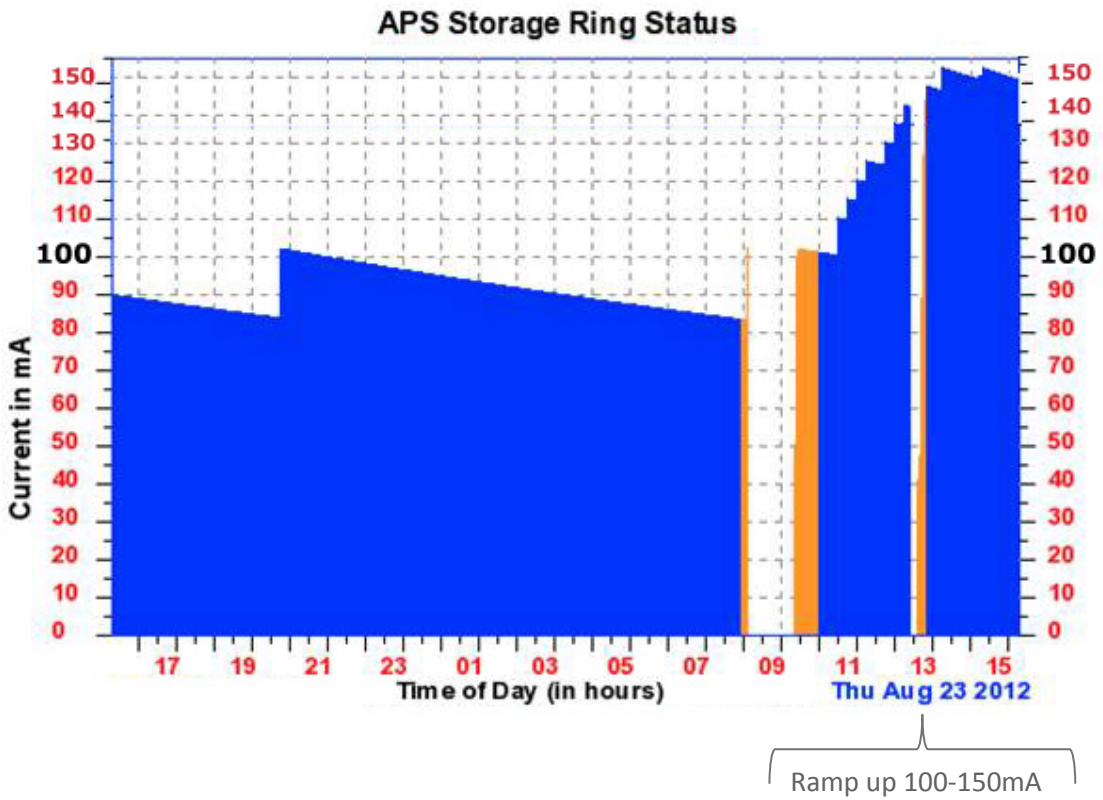
Read more »

Trends: Accelerator Performance



- **Outstanding FY12 performance:**
- Mean Time Between Faults: 200 hrs (25 in 5000 hrs)
- Scheduled Time Not Delivered: 0.6% (30 hrs)

150-mA Study with User Participation



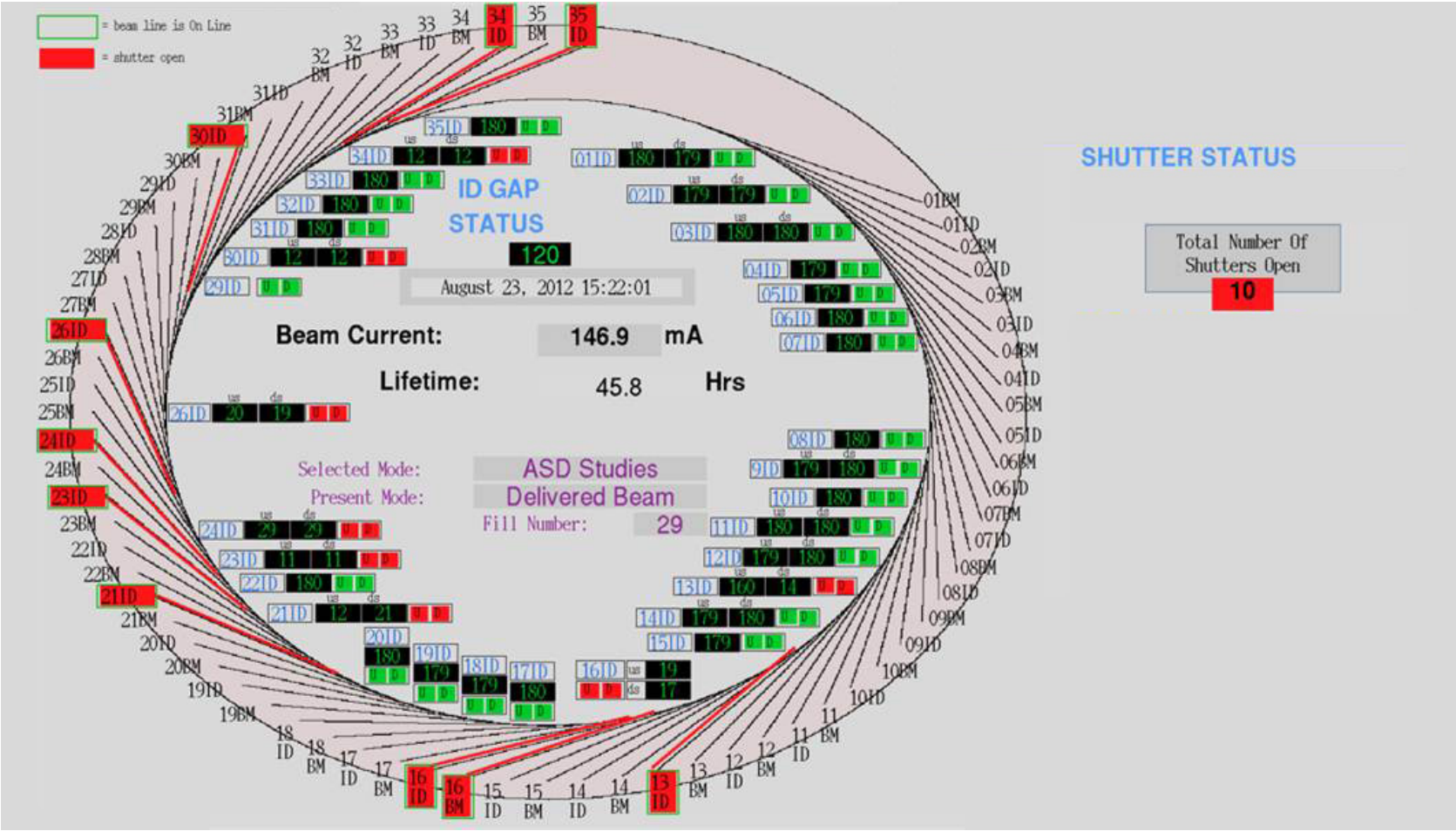
Objective:

Allow Users to study the performance of their beamline optics up to 150 mA.

Criteria for participation:

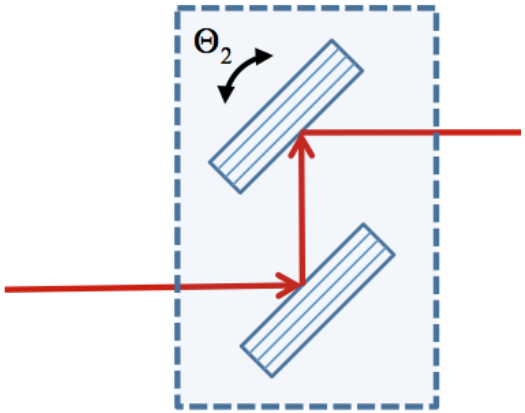
Front End and Beamline Shielding components OK to operate up to 150 mA with no ID gap restrictions.
All other beamlines taken off-line with open ID gaps.

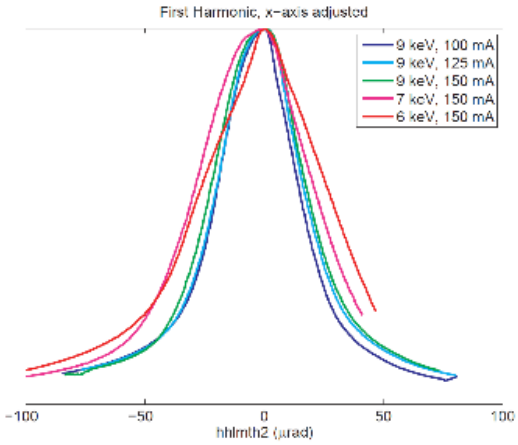
150-mA Study with User – Shutters open in red

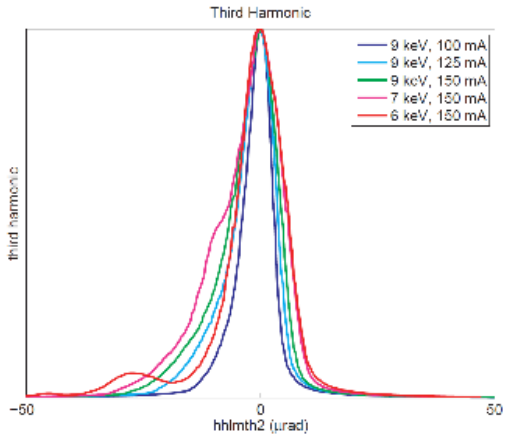


150-mA Sector 30 High Heat Load Monochromator

Diamond (111) and (333) Rocking Curves vs. Current







Diamond (111)

First harmonic broadens with increasing power.

Diamond (333)

Third harmonic broadens until a shoulder and finally a satellite peak appears. Behavior attributed to an increasing gradient of lattice spacings in the beam spot.

Beneficial Occupancy for Bldg 400A this month

SPX support building inside ring near sectors 5-7 will provide space for:

- Cryogenic plant (cold box, helium and LN2 tanks, heat exchangers, compressors)
- Multiple klystrons
- Wells for testing superconducting RF devices

APCF Construction

Advanced Protein Crystallization Facility (APCF)

APCF Construction Milestones

Construction Start	August 2012
Foundations	December 2012
Structural Steel	December 2012
Building Enclosure	April 2013
Beneficial Occupancy	Nov 2013
Final Completion	April 2014

Ground breaking August 30, 2011 – Live Web Cam <http://apcfcam1.aps.anl.gov/view/viewer_index.shtml?id=14388>

Slated to open in 2014

Construction Vibrations in 400 Area

- Vibrations from construction activities can disrupt experiments.
- Where possible we are avoiding high impact construction activities during user operations.
- For APCF construction, we are measuring which activities produce excessive vibration and scheduling these during non-user-operations periods.

Vibrations

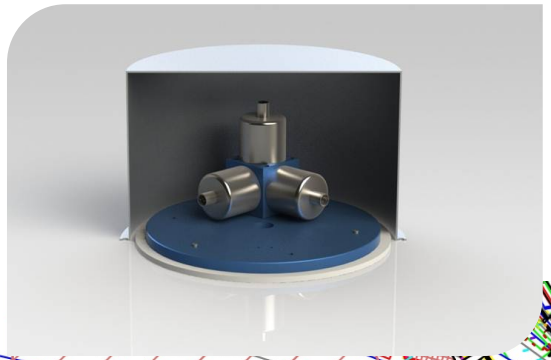
Construction equipment evaluated as part of contract with construction company

- Each piece of construction equipment that may generate excessive vibrations must be tested during a studies day prior to its use.
- APS will evaluate the equipment's impact on facility operations.
- Equipment causing excessive vibration is not allowed to be used during user operations.

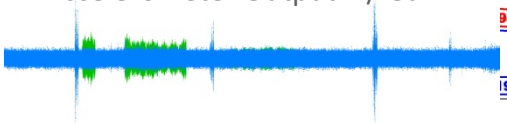
Vibrations

Phase I Monitoring Locations

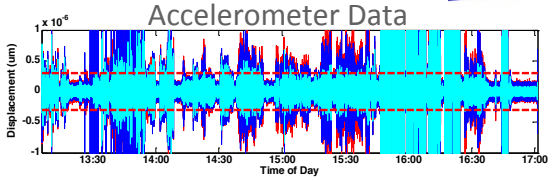
- S05ID
- S19ID
- S21ID
- S23ID
- S26ID

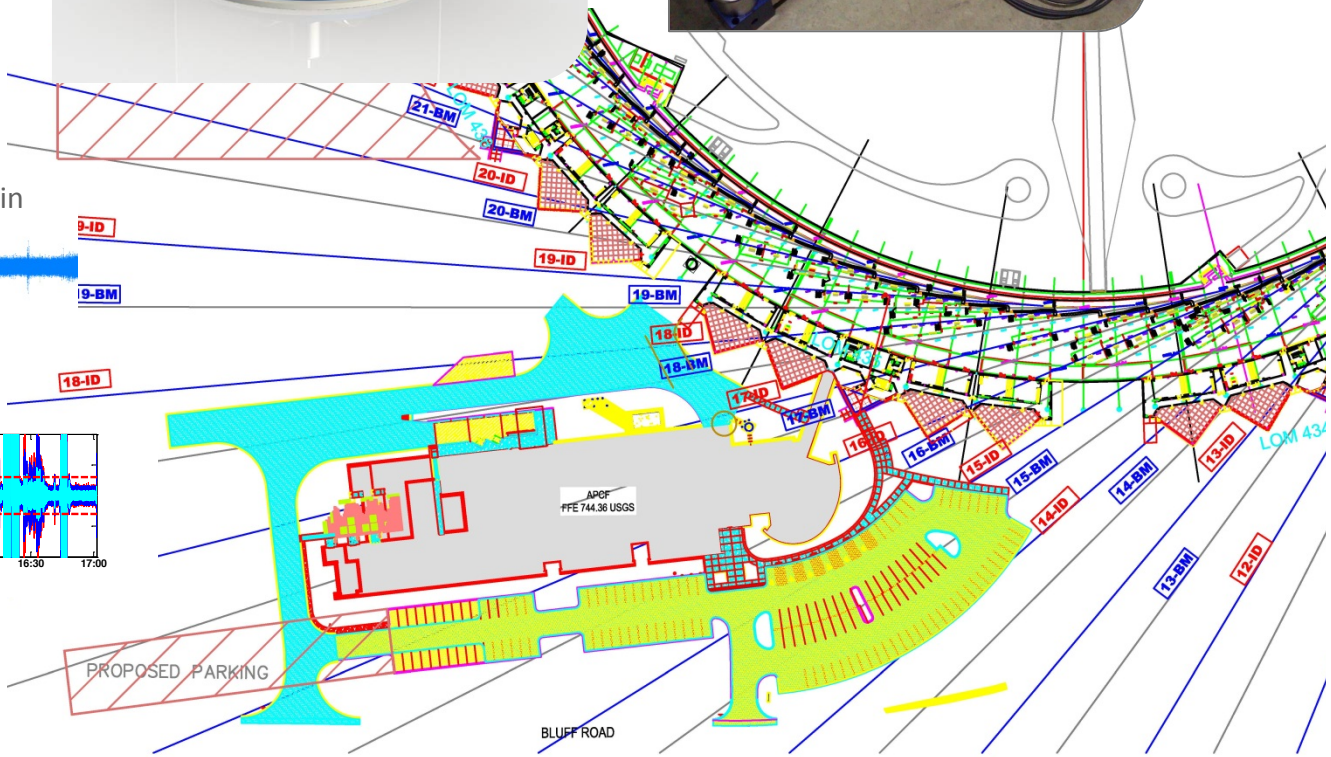


Accelerometer Output w/ Gain



Accelerometer Data



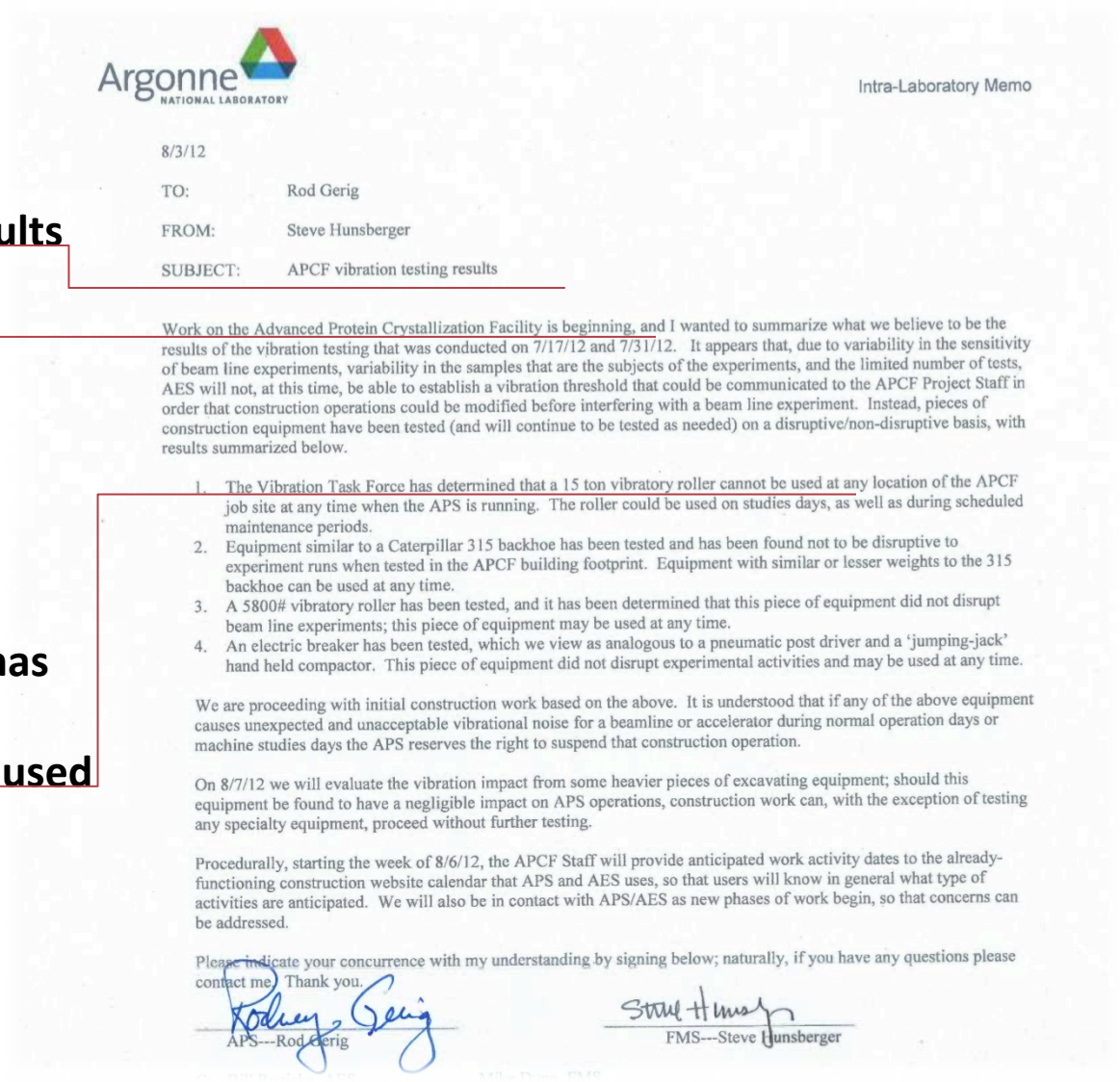


Vibrations

APCF vibration testing results

Work on the Advanced Protein Crystallization facility is beginning

The Vibration Task Force has determined that a 15 ton vibratory roller cannot be used



Argonne NATIONAL LABORATORY

Intra-Laboratory Memo

8/3/12

TO: Rod Gerig

FROM: Steve Hunsberger

SUBJECT: APCF vibration testing results

Work on the Advanced Protein Crystallization Facility is beginning, and I wanted to summarize what we believe to be the results of the vibration testing that was conducted on 7/17/12 and 7/31/12. It appears that, due to variability in the sensitivity of beam line experiments, variability in the samples that are the subjects of the experiments, and the limited number of tests, AES will not, at this time, be able to establish a vibration threshold that could be communicated to the APCF Project Staff in order that construction operations could be modified before interfering with a beam line experiment. Instead, pieces of construction equipment have been tested (and will continue to be tested as needed) on a disruptive/non-disruptive basis, with results summarized below.

1. The Vibration Task Force has determined that a 15 ton vibratory roller cannot be used at any location of the APCF job site at any time when the APS is running. The roller could be used on studies days, as well as during scheduled maintenance periods.
2. Equipment similar to a Caterpillar 315 backhoe has been tested and has been found not to be disruptive to experiment runs when tested in the APCF building footprint. Equipment with similar or lesser weights to the 315 backhoe can be used at any time.
3. A 5800# vibratory roller has been tested, and it has been determined that this piece of equipment did not disrupt beam line experiments; this piece of equipment may be used at any time.
4. An electric breaker has been tested, which we view as analogous to a pneumatic post driver and a 'jumping-jack' hand held compactor. This piece of equipment did not disrupt experimental activities and may be used at any time.

We are proceeding with initial construction work based on the above. It is understood that if any of the above equipment causes unexpected and unacceptable vibrational noise for a beamline or accelerator during normal operation days or machine studies days the APS reserves the right to suspend that construction operation.

On 8/7/12 we will evaluate the vibration impact from some heavier pieces of excavating equipment; should this equipment be found to have a negligible impact on APS operations, construction work can, with the exception of testing any specialty equipment, proceed without further testing.

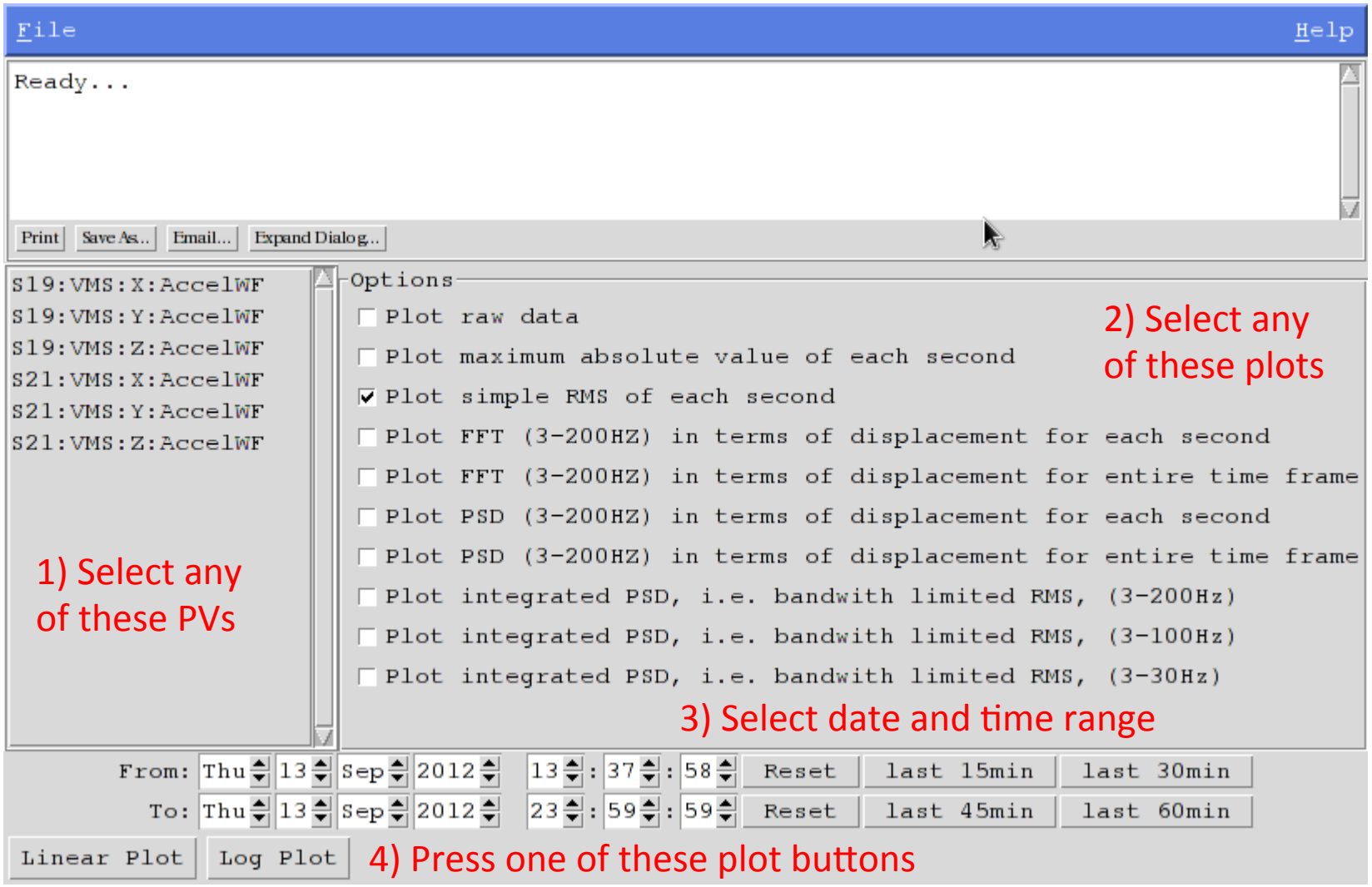
Procedurally, starting the week of 8/6/12, the APCF Staff will provide anticipated work activity dates to the already-functioning construction website calendar that APS and AES uses, so that users will know in general what type of activities are anticipated. We will also be in contact with APS/AES as new phases of work begin, so that concerns can be addressed.

Please indicate your concurrence with my understanding by signing below; naturally, if you have any questions please contact me. Thank you.

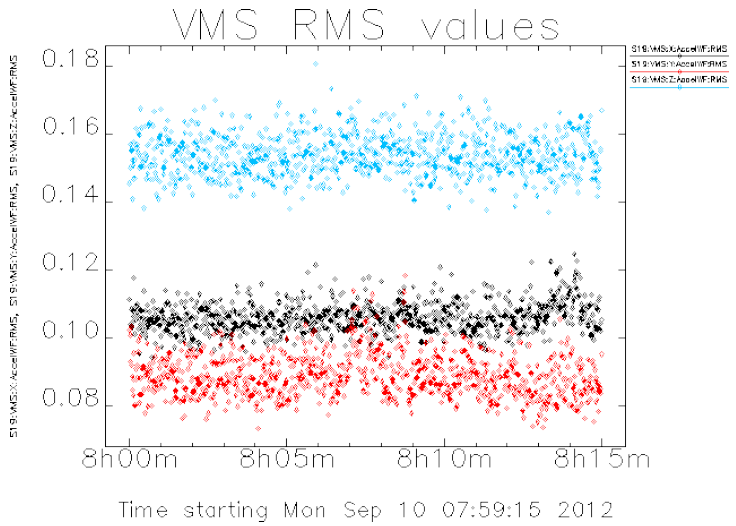
APS---Rod Gerig

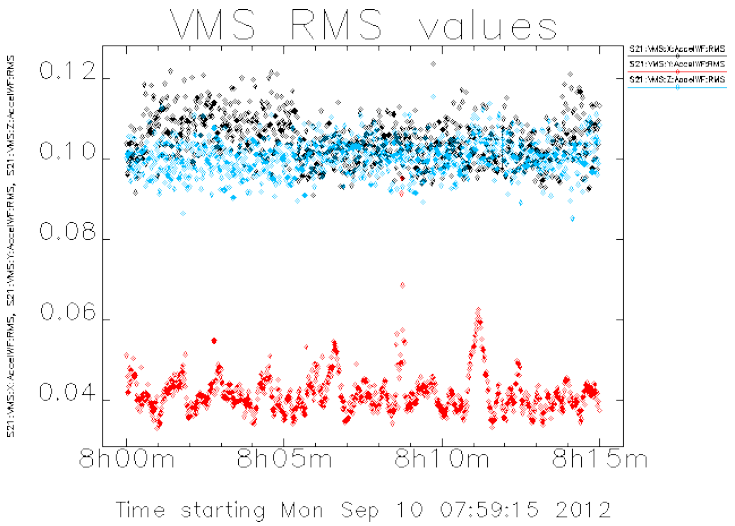
FMS---Steve Hunsberger

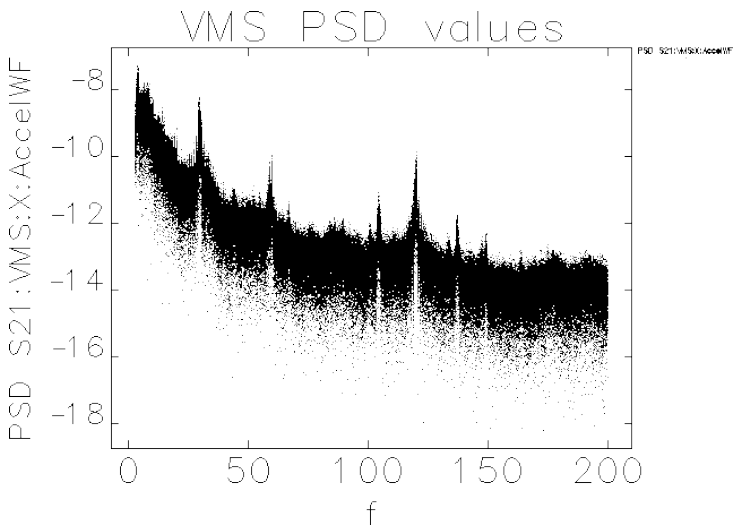
Existing Beam Diagnostics Tools Being Deployed to Analyze Vibrations

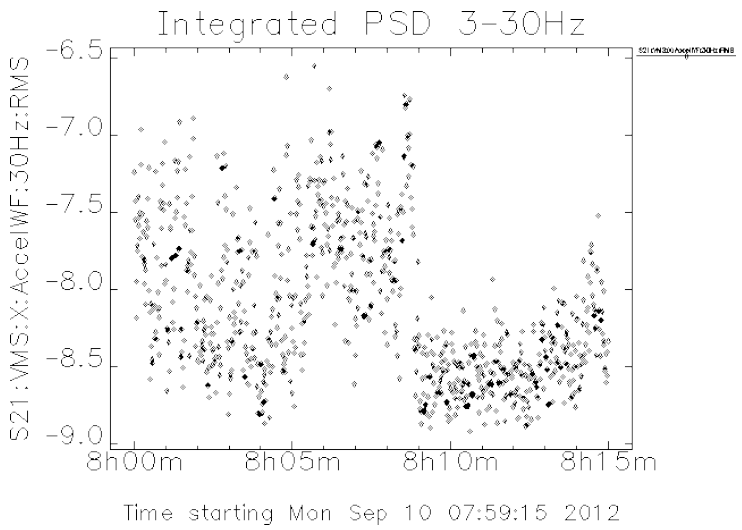


Some Plots of Vibration Data









Top left: The three S19 devices rms every second (units mm); **Top right:** The three S21 devices rms every second (units are mm).
Bottom left: Psd of 15 minutes window of S19:x in log scale (units log10(mm^2/Hz)); **Bottom right:** Cumulative PSD to 30 Hz for each second of S19:x in log scale (units log10(mm)).

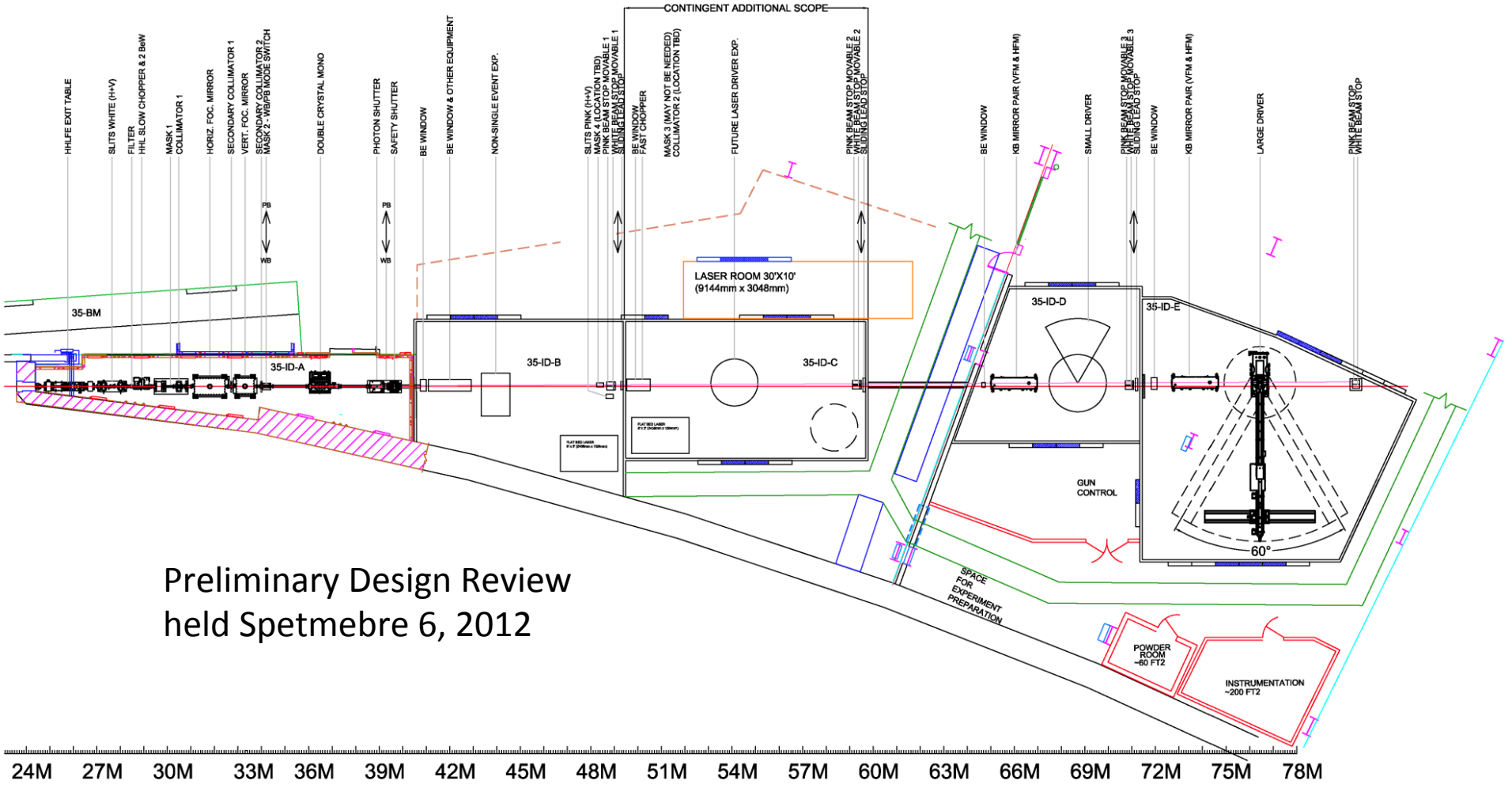
DCS MOU Ceremony – September 6, 2012

Pictured left to right: Prof. Yogendra Gupta PI – Institute of Shock Physics WSU, Dr. G. B. Stephenson – APS Director, Dr. Eric D. Isaacs – Laboratory Director Argonne, Dr. Chris Deeney – NNSA, Dr. Daryll DeWald – Dean, College of Arts and Sciences WSU, Dr. Keith LeChien - NNSA

Sector 35 Being Cleared for DCS

- Diagnostics monitors will remain at 35-BM, diagnostics research will move from 35-ID to 30-ID

DCS Beamline Layout at Sector 35

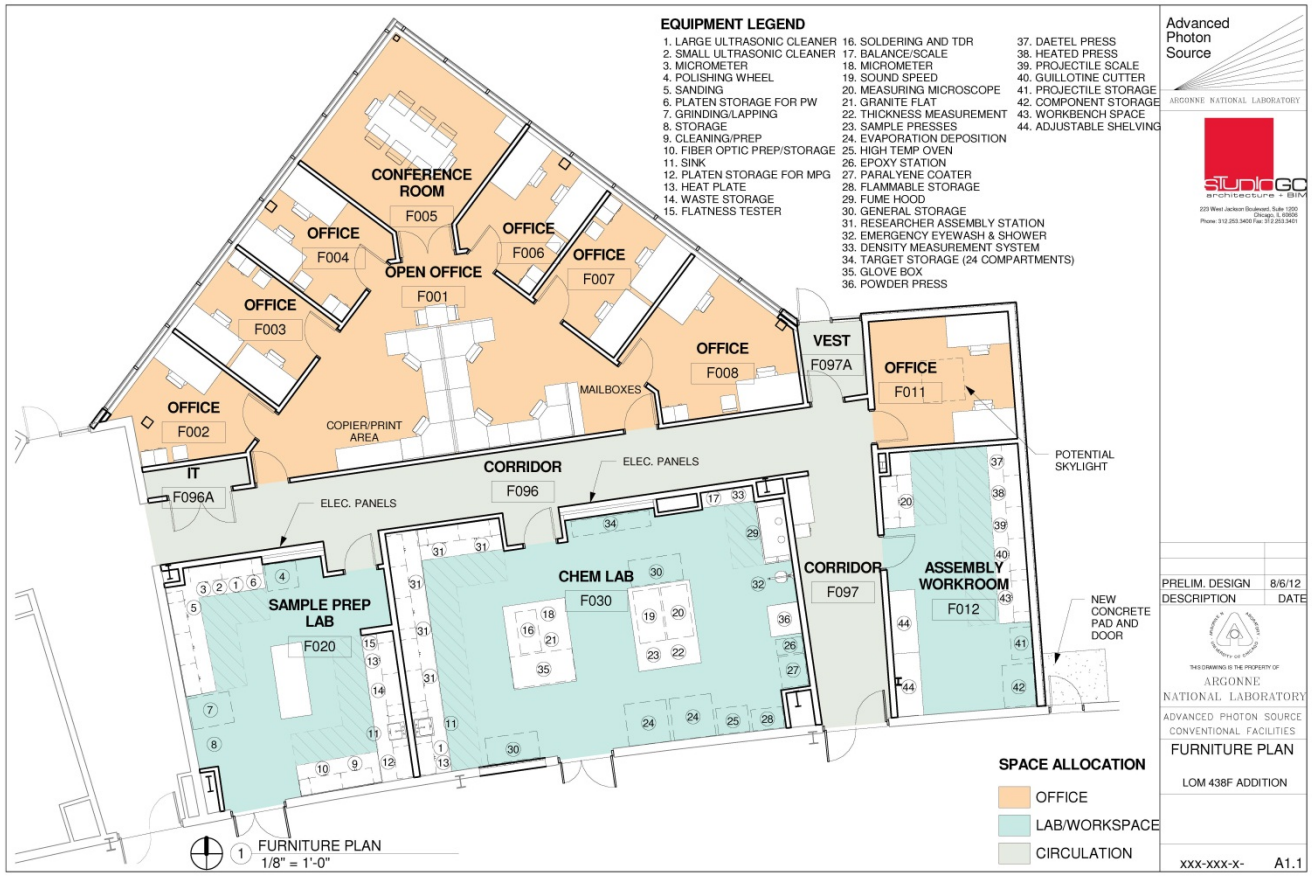


Preliminary Design Review
held Spetmebre 6, 2012

DCS Project LOM 438F Pentagon

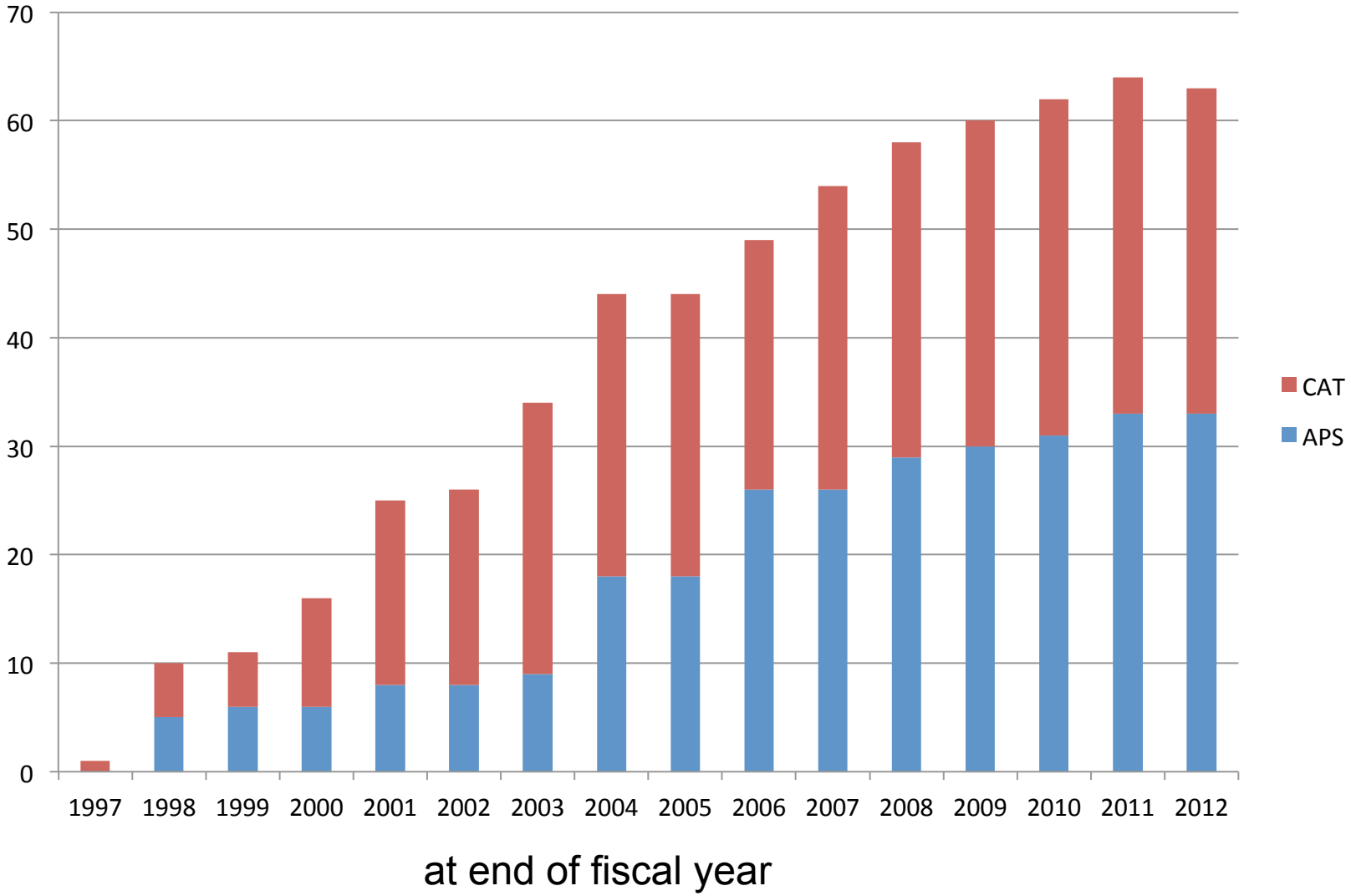
Planned
LOM 438F

DCS Project LOM 438F Pentagon

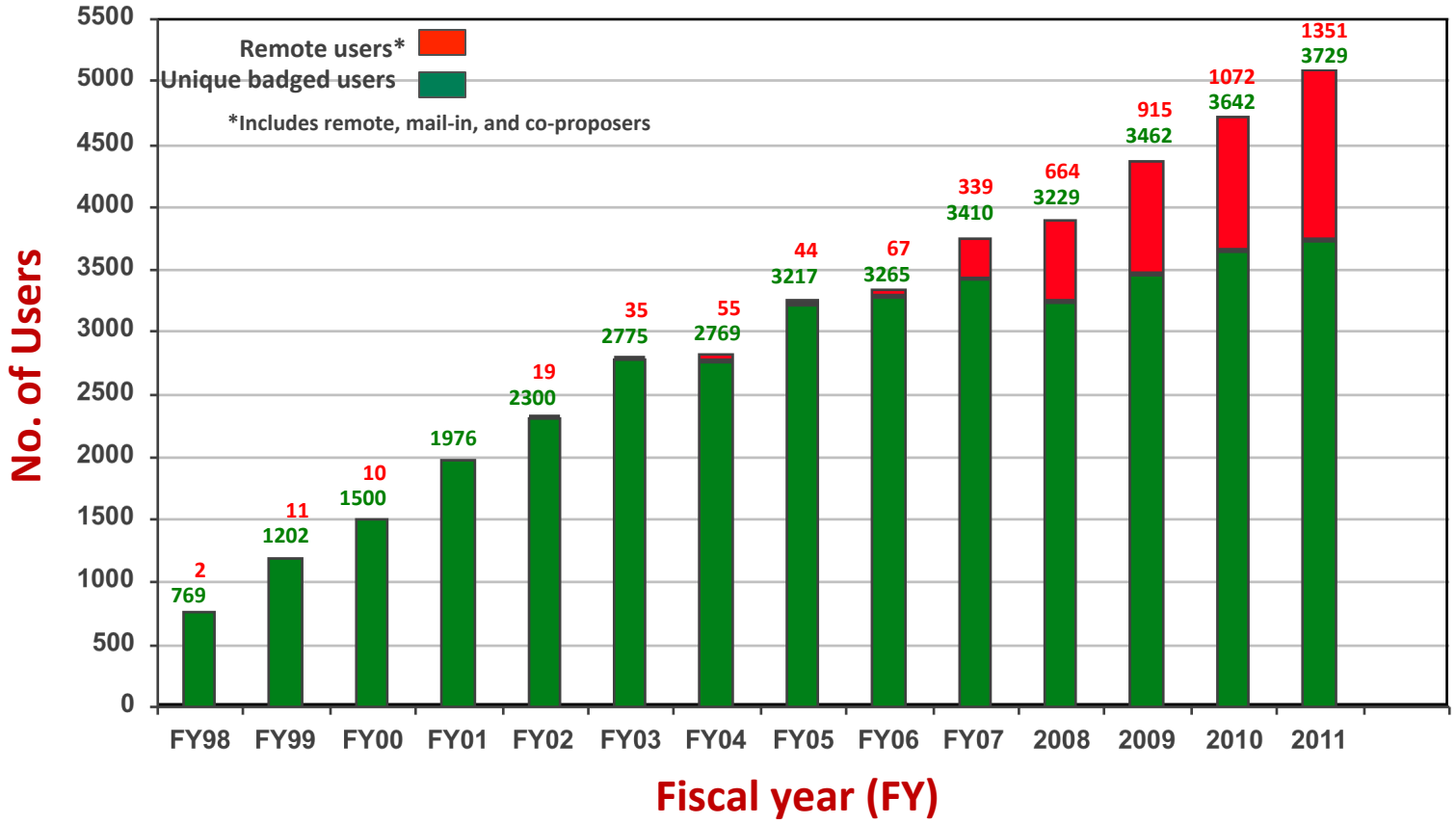


Dynamic Compression Sector (DCS) Project

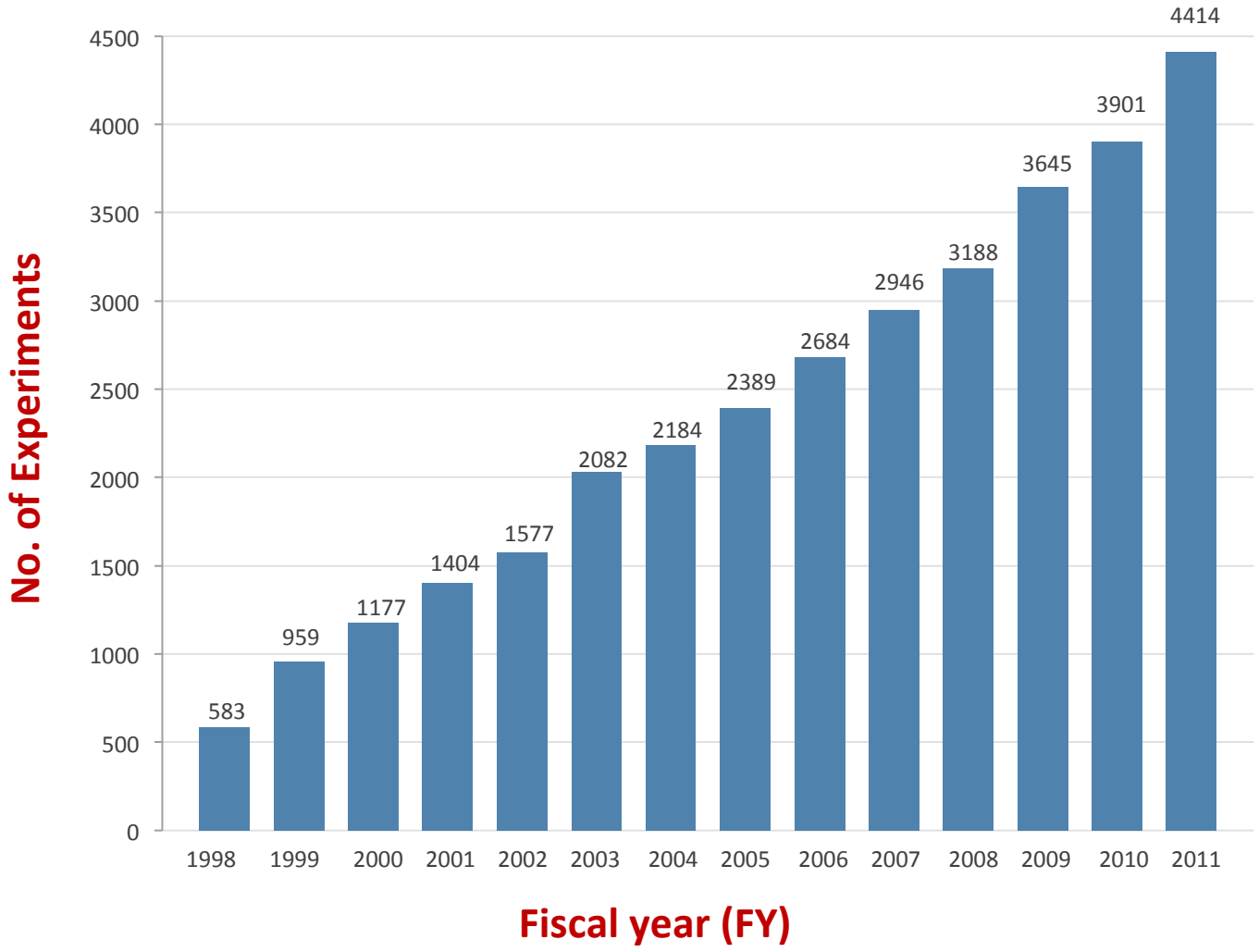
Trends: Operating Beamlines



Trends: Users (on-site and remote)

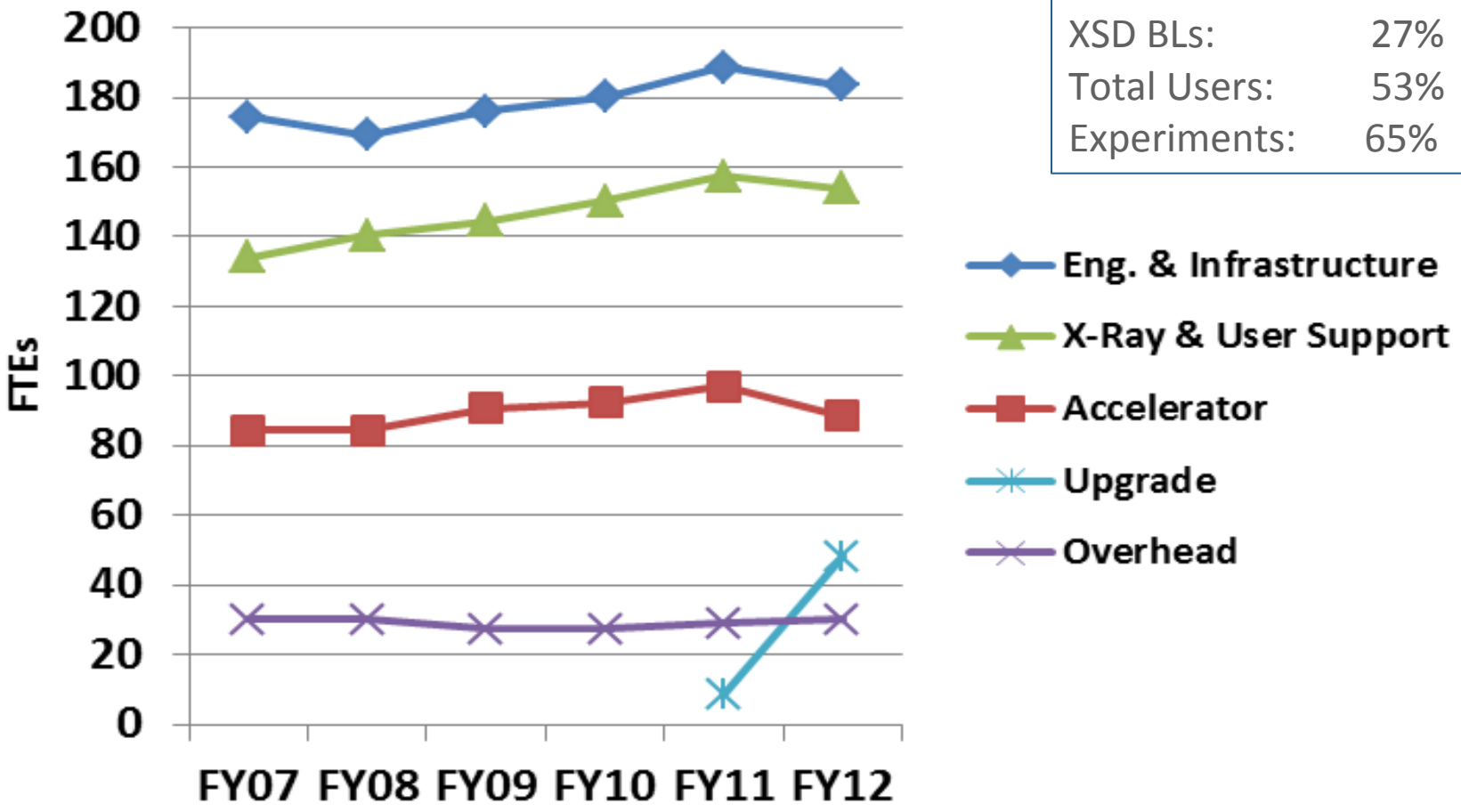


Trends: Experiments

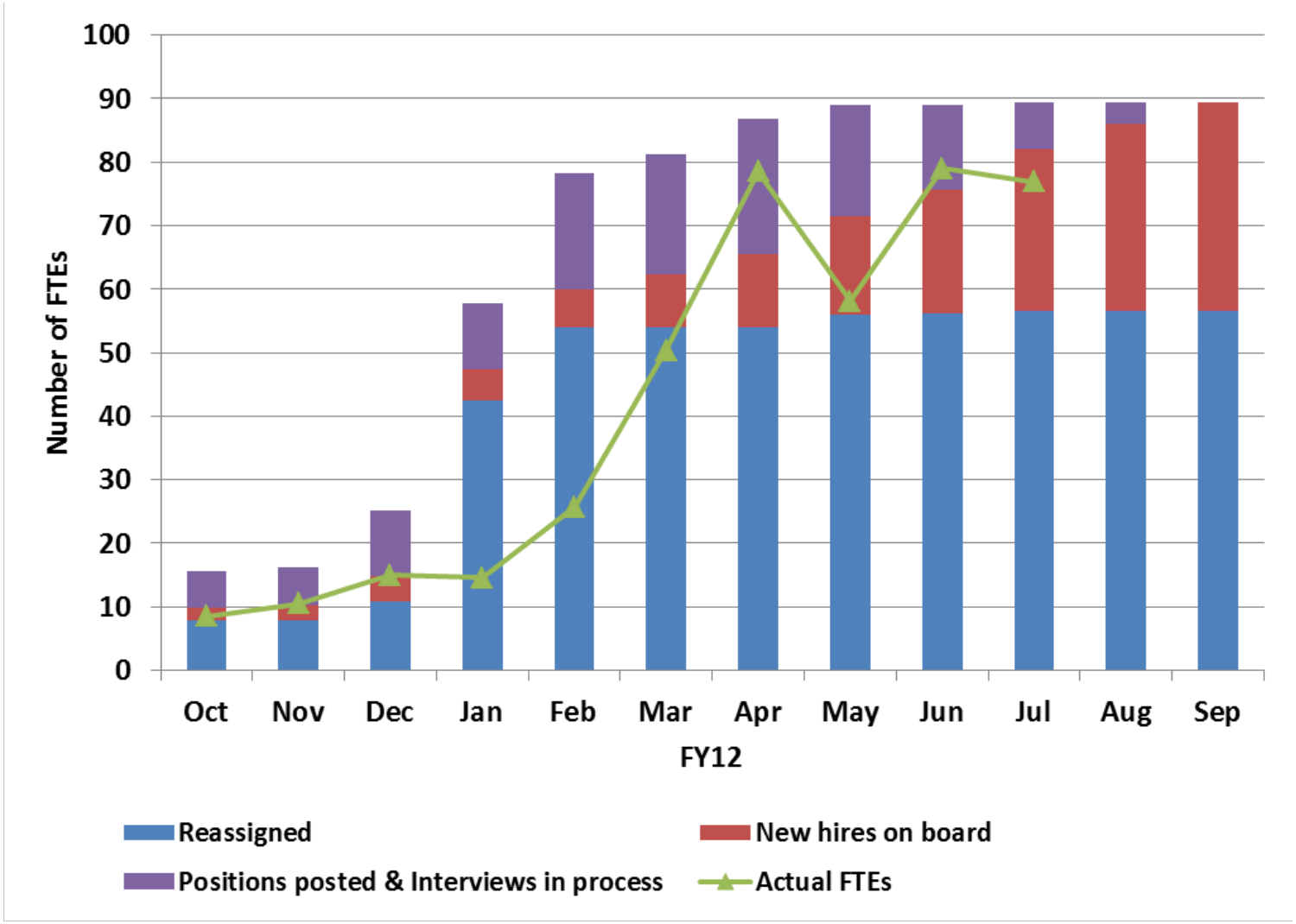


APS FTE History:
Increasing Operations Efficiency

5-year increases:	
Ops FTEs:	8%
XSD FTEs:	15%
Total BLs:	17%
XSD BLs:	27%
Total Users:	53%
Experiments:	65%



APS Upgrade Staffing: A Major Transition in FY12



Plans to Accommodate Users During NSLS-I to -II Transition

- Reduction in capacity expected at NSLS for several years beginning FY14
- APS, SSRL, and ALS are developing plans to provide capacity during the transition between NSLS-I and NSLS-II
- APS can already accommodate more users in some automated techniques
- We can quickly and economically increase capacity for scattering, spectroscopy, topography, high P, etc. at several existing bending-magnet beamlines by adding staff and/or equipment

APS Bending Magnet Capacity for NSLS-I to NSLS-II Transition

Beamline (Operator)	Current Techniques	Potential Techniques	Estimated Capacity Available (BL)	Estimated Capacity Available (Users/yr)	One-time Costs for Increased Capacity (K$)	Recurring Costs for Increased Capacity (K$)	Comments on Costs	Funding Priority *
11-BM (XSD)	Powder diffraction	Powder diffraction	0.20	20	0	0	(robot throughput, no additional cost)	**NA**
6-BM (XSD)	Currently not operating	White beam diffraction (incl. high pressure)	1.00	100	500	400	white beam slits, high pressure instrument; Staff Scientist and Scientific Assoc. (COMPRES could contribute part)	**1**
1-BM (XSD)	Powder diffraction	Scattering & topography	0.50	50	0	225	Staff Scientist	**2**
9-BM (XSD)	XAFS	XAFS	0.50	50	550	400	quick EXAFS mono; Staff Scientist and Scientific Assoc. (Exxon could contrib. part)	**3**
2-BM (XSD)	Tomography	Tomography	0.20	20	85	175	high speed camera; Scientific Assoc.	**4**
17-BM-B (IMCA/XSD)	Protein crystallography	Powder diffraction	0.25	25	0	175	Scientific Assoc.	**5**
33-BM-C (XSD)	General diffraction /surface scattering	General diffraction /surface scattering	0.25	25	0	175	Scientific Assoc.	**6**
12-BM (XSD)	XAFS and general diffraction	XAFS and general diffraction	0.25	25	480	0	mirror for 10X flux, fluorescence detector	**7**
8-BM (XSD)	Microfluoresence	Microfluoresence	0.25	25	125	225	KB mirror; Staff Scientist	**8**
5-BM-C (DND CAT)	Powder diffraction & microCT	Powder diffraction & microCT	0.10	10	110	0	high throughput detector in APS detector pool	**9**
14-BM-D (BioCARS)	Currently not operating	High pressure - mono beam	1.00	100	700	625	mirror, mono, controls/IT; 2 Staff Scientists and Scientific Assoc. (COMPRES could contribute part)	**10**
TOTAL			**4.5**	**450**	**2550**	**2400**		
19-BM-D (SBC CAT)	Protein crystallography	Protein crystallography	0.10	20	0	0		
22-BM-D (SER CAT)	Protein crystallography	Protein crystallography	0.25	50	0	100	0.5 Staff Scientist	
23-BM-B (GM/CA)	Protein crystallography	Protein crystallography	0.25	50	0	100	0.5 Staff Scientist	
14-BM-C (BioCARS)	Protein crystallography	Protein crystallography	0.5	100	0	225	Staff Scientist	
24-BM-B (NE CAT)	Currently not operating	Life sciences	1	200	500	625	PSS, optics installation, controls/IT, floor space; 2 Staff Scientists and Scientific Assoc.	
TOTAL			**2.1**	**420**	**500**	**1050**		
GRAND TOT.			**6.6**	**870**	**3050**	**3450**		

*Priority based on capacity, cost, APS interests; still need to better incorporate needs of NSLS community

APS User Support Space Planning

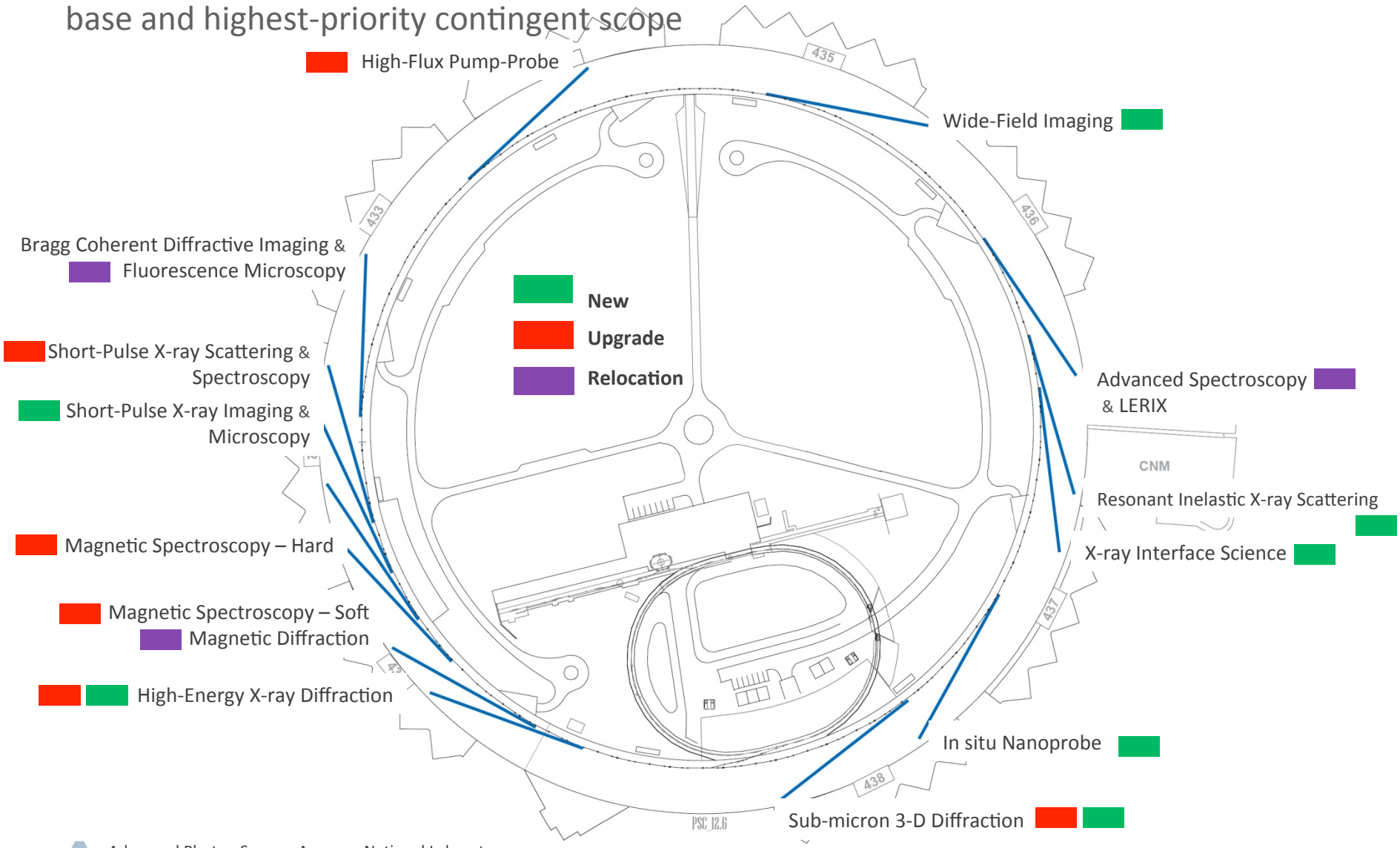
- Drivers for expansion of beamline office space:
  - Current LOM overcrowding (343 occupants, 290 capacity)
  - Accommodating NSLS-I to NSLS-II transition
  - APS Upgrade

- APS Roadmap completed in May 2012 gave planned locations of future beamlines and thus needed offices

	Current	2-3 years	End of APS-U	Beyond APS-U
Number of Beamlines	63	71	79	84
Number of Beamline Occupants	343	386	441	479

APS Upgrade Beamline Locations

Net increase of 11 new experimental stations in APS-U base and highest-priority contingent scope



Alternatives

- Need is for user support space directly adjacent to beamlines distributed around ring
- Vertical LOM expansion avoids costs of moving roadways, wetlands
- Creating a design for expanding LOM by LOM gives flexibility for future expansion as and where needed without redesign costs
- We are also considering a building south of CNM
- Argonne plans IGPP funding starting in FY13 to expand APS user support space
- Likely FY13 activities: build out interior of LOM 437, design new building next to CNM

Building Location Adjacent to APS, CNM

- Adjacent to several new beamlines and CNM

2012 Neutron X-ray Scattering School

August 12-24, 2012, at Argonne and Oak Ridge National Labs

- 63 graduate students from 51 universities and 1 industrial lab
- Received 29 lectures on x-ray/neutron scattering, optics, detectors, and specific techniques in mornings, did experiments in the afternoons
- Students performed experiments on 23 different APS beamlines with the help of ~50 CAT and APS staff
- Training future generation of users, ≳75% of students continue to use facilities post-graduation.

The Argonne Exemplary Student Research Program

- During 2011-2012 school year the Exemplary Student Research Program spearheaded by the Argonne Education Division brought three teams of high school students and teachers to Argonne
- Working with resident users and staff scientists from the U.S. Department of Energy Office of Science's Advanced Photon Source and Electron Microscopy Center the students gained hands-on experience in seeing a research project through from idea to reality
- The program is being greatly expanded for 2013 providing a greater number of student teams with access to more APS user facilities

Neuqua Valley High School students at GSECARS beamline 13-ID-E at the APS (top) and preparing samples under the guidance of GSECARS staff scientist Matt Newville.

The APS/ANL Energy Showcase, September 15, 2012

- Estimated number of public attendees: 12,500 (per CEPA)
- Number of APS staff manning exhibits: 84
- Number of APS staff acting as tour guides: 50
- Exhibits by all APS Divisions + Upgrade



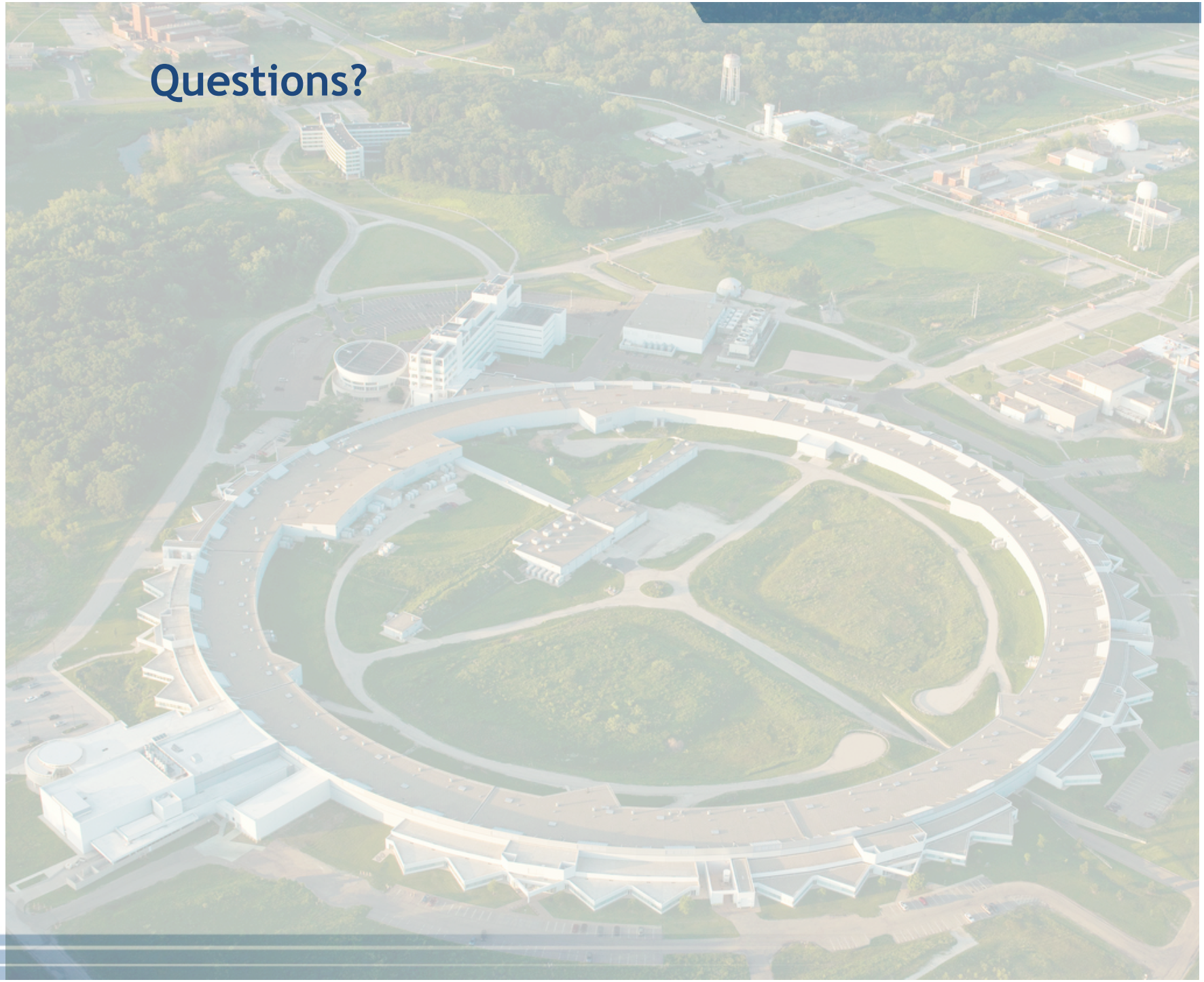









Questions?



Bonus Slides

Energy Showcase 2012

September 15, 2012

Open House was a success.
Thank you for the help.

APS Exhibits

- Beamline tour
- Infrared Visuals
- Levitation using sound
- Interactive control system of a linear accelerator
- Simulated electron beam
- Solar energy exhibit
- Scientists focus electron beams
- Miniature beamline
- Alter trajectory of a laser
- The principles of magnetism demonstrated